

WHAT IS CLAIMED IS:

1. A method for identifying at least one molecule in a substantially transparent medium, the method comprising:

transmitting high-power, ultra-short laser pulses into the medium so as to generate filaments in which a spontaneous fluorescence signal propagating along an axis of said filament is amplified by stimulated emission;

detecting said amplified spontaneous fluorescence signal; and

analyzing said fluorescence signal to identify said molecule.

2. A method as claimed in claim 1, wherein said amplified spontaneous fluorescence signals are detected along a direction opposite to said transmitted laser pulses.

3. A method as claimed in claim 1, wherein said transmitting comprises transmitting femtosecond laser pulses.

4. A method as claimed in claim 1, wherein said transmitting comprises transmitting using a terawatt femtosecond Ti-sapphire laser system.

5. A method as claimed in claim 2, wherein said detecting comprises measuring said signal over a desired time interval corresponding to a desired range.

6. A method as claimed in claim 5, wherein said detecting comprises using a shutter to select said desired time interval within said desired range by setting said shutter to open after a predetermined time period.

7. A method as claimed in claim 1, wherein said transmitting comprises transmitting said laser pulses from ground to sky.
8. A method as claimed in claim 1, wherein said at least one molecule is nitrogen and said substantially transparent medium is the atmosphere.
9. A method as claimed in claim 1, wherein said transmitting comprises transmitting said laser pulses into the atmosphere to perform atmospheric analysis.
10. A method as claimed in claim 1, wherein said at least one molecule is selected from a group consisting of carbon monoxide, carbon dioxide, ethylene, and Butane.